Canadian Grain Commission | Commission canadienne des grains

ISSN 1182-4417

Quality of western Canadian malting barley 2010

Aaron L. MacLeod
Chemist, Applied Barley Research

Michael J. Edney
Program Manager, Applied Barley Research

Marta S. Izydorczyk
Program Manager, Basic Barley Research

Contact: Aaron MacLeod
tel.: 204-983-6154
email: aaron.macleod@grainscanada.gc.ca

Grain Research Laboratory
Canadian Grain Commission
1404-303 Main Street
Winnipeg MB R3C 3G8
www.grainscanada.gc.ca

Canada

Table of contents

Quality of western Canadian malting barley - 2010 ..... **3**

Summary 3

Introduction 4

Growing and harvesting conditions 7

Production, yields and quality 7

Sampling and survey methodology 9

Malting quality 9

AC Metcalfe 10

CDC Copeland 12

Newdale 14

Legacy 16

Tradition 18

Methods **20**

Acknowledgments **22**

Tables

Table 1 - Malting barley cultivars recommended for production in western Canada by the CMBTC, its members, and others in the Canadian barley industry (2011-2012) 4

Table 2 - Seeded acres of malting cultivars (percentage of total area seeded to malting barley) 5

Table 3 - Barley production in western Canada for 2010, 2009 and the 2001-2010 average 8

Table 4 - Malting conditions used with Phoenix Micromalting System 8

Table 5 - Quality data for 2010 harvest survey composite samples of AC Metcalfe malting barley 11

Table 6 - Quality data for 2010 harvest survey composite samples of CDC Copeland malting barley 13

Table 7 - Quality data for 2010 harvest survey composite samples Newdale malting barley 15

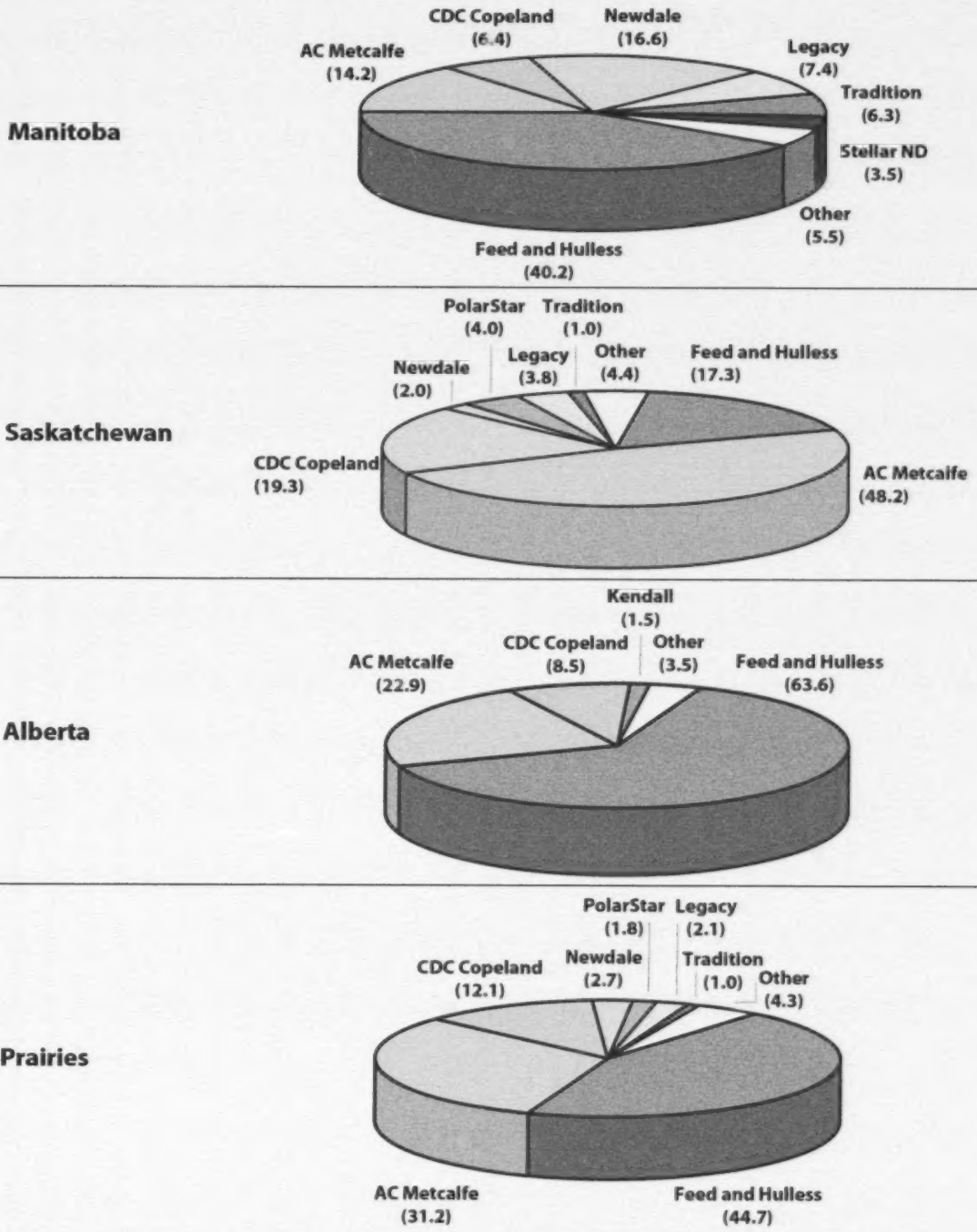
Table 8 - Quality data for 2010 harvest survey composite samples of Legacy malting barley 17

Table 9 - Quality data for 2010 harvest survey composite samples of Tradition malting barley 19

Figures

Figure 1 - Distribution of barley cultivars in 2010 by region (as percent of total area seeded to barley) 2

Figure 1 – Distribution of barley cultivars in 2010 by region (as a percentage of total barley seeded acreage)[1]



[1] Data obtained from the CWB Variety Survey 2010.

Quality of western Canadian malting barley 2010

Summary

The quality data for the 2010 harvest was derived from 75 separate varietal composites, representing a total of 381,447 tonnes of barley selected for malting purposes.

Barley crop production for 2010, at 6,984,000 tonnes, was 28% lower than the 10-year average of 9,752,000 tonnes. This was largely attributable to reductions in total seeded acres to barley and record high amounts of rainfall across the prairie provinces during the growing and harvest seasons resulting in a negative impact on crop production.

The growing season was greatly affected by excess moisture, which, combined with little heat and sunshine, resulted in crops not maturing as quickly as normal. Wet conditions continuing into fall resulted in a delayed harvest and downgrading of large portions of the crop due to mildew, frost damage and *fusarium*; limiting the quantity of selectable barley available.

Malting barley selected in 2010 was overall of average quality. Thousand kernel weights and kernel plumpness levels were below long term averages. Protein levels were moderate, rising only slightly from 2009. Barley germination energy levels in 2010 were adequate in general; however water sensitivity was present in most samples requiring modification of standard malting regimes. RVA values were poor (low), indicating high incidence of pre-harvest sprouting throughout the crop. As expected, dormancy was present in some six-rowed varieties.

Malt made from 2010 barley exhibited average levels of extract, good levels of protein modification, slightly elevated beta-glucan levels, and above average levels of enzyme activity promoting good brewing performance. Production of good quality malt was possible from 2010 barley with the application of appropriate malting conditions.

Introduction

The 2010 malting barley survey is the 23rd consecutive survey conducted in this general format. The data for this report is based on the analysis of representative varietal composite samples which have been selected for domestic processing or for export as malting barley. Industry participation in preparing and submitting these composites is essential for completion of a successful survey. Submitted barley samples are analysed for quality and then micromalted. Malt quality is analysed using ASBC standard methods of analysis.

This report contains a discussion of the heritage and characteristics of the major varieties, which make up the portfolio of malting barley varieties currently being grown and selected in Canada. AC Metcalfe was once again the most popular variety grown in western Canada occupying 31.2% of total acres sown to barley in 2010 (Figure 1). CDC Copeland remained in second place among malting barley varieties with seeded area increasing to 12.1% of barley acres. Newdale became the third most popular malting variety with 2.7% of total barley acres, replacing Kendall which fell to only 1.2% of total barley acres. Acres seeded to six-rowed malting varieties decreased significantly in 2010. Legacy is still the top six-rowed malting variety at 2.1% of total barley acres followed by Tradition at 1.0% and Stellar-ND at 0.5%.

The Canadian Malting Barley Technical Center (CMBTC), in collaboration with its member organizations and other barley industry groups, has produced a Recommended Malting Barley Varieties List with anticipated market demand, which is intended as a guide to assist producers in the selection of varieties for seeding in the coming year. Table 1 lists the recommended malting barley cultivars for 2011-2012.

Table 1 – Malting barley cultivars recommended for production in western Canada by the CMBTC, its members, and others in the Canadian barley industry (2011-2012)

Recommended two-rowed malting varieties

Variety	Domestic	Export	Market outlook
AC Metcalfe	Established	Established	Stable demand
CDC Copeland	Established	Established	Stable demand
Newdale	Limited	Limited	Stable demand
CDC Kendall	Established	Established	Declining demand
CDC Polarstar	Limited	Limited	Increasing demand

Recommended six-rowed barley varieties

Variety	Domestic	Export	Market outlook
Legacy	Established	Established	Declining demand
Tradition	Established	Established	Declining demand
Stellar-ND	Limited	Limited	Increasing demand

Table 2 – Seeded acres of malting barley cultivars (as a percentage of total area seeded to malting barley)[1]

Two-rowed cultivars	2010	2009	2006-2010 average	Six-rowed cultivars	2010	2009	2006-2010 average
AC Metcalfe	56.3	51.0	50.5	Legacy	3.9	6.2	6.9
CDC Copeland	21.9	21.1	17.7	Tradition	1.8	6.3	4.1
Newdale	4.9	4.7	4.0	Stellar ND	1.0	0.0	0.2
CDC Polarstar	3.3	0.0	0.7	Lacey	0.6	1.2	1.4
CDC Kendall	2.2	5.9	7.8	Robust	0.2	0.4	1.0
Harrington	1.2	1.3	2.1	CDC Yorkton	0.2	0.3	0.3
Merit	0.6	0.1	0.6	CDC Battleford	0.2	0.1	0.2
Meredith	0.6	0.0	0.1	Other	0.2	0.8	1.2
Other	0.9	0.6	1.4				

[1] Data obtained from the CWB Variety Survey 2010.

AC Metcalfe, a cross of Oxbow x Manley, was fully registered in 1997, and was crossed by Dr. R. Metcalfe at AAFC Winnipeg, and by Dr. W. Legge at AAFC Brandon. It is a high yielding, early maturing variety, with good disease resistance and lodging resistance. Malting characteristics include improved peeling resistance, higher extract levels, higher enzyme levels, low wort beta-glucan, and faster modification rates. These factors translate into good brewing performance, with fast lautering and conversion times, and suitability for use in higher adjunct brewing. AC Metcalfe is continues to be the most widely grown two-rowed variety, occupying over 50% of all malt barley acreage.

CDC Copeland, a two-rowed cross of WM861-5/TR118, registered in 1999, was developed by Dr. B. Harvey, Crop Development Centre, University of Saskatchewan. It is a high yielding, early maturing variety, with good resistance to disease and lodging. CDC Copeland processes easily and modifies similarly to Harrington, with similar extract and enzyme levels, but has lower levels of soluble protein, colour, and wort beta-glucan than Harrington. It has good overall brewing characteristics, and with its quality and lower modification profile, provides an excellent balance within the portfolio of malting barley varieties. CDC Copeland production levels now exceed 20% of total malting barley production.

Newdale, a two-rowed cross of CDC Stratus/TR 236, was fully registered in 2001, and was developed by Dr. W. Legge, AAFC Brandon Research Centre. Newdale is now being grown in significant quantities particularly in the eastern half of the Prairies. It has excellent yield, is one day later than AC Metcalfe in maturity, has good disease resistance and good lodging resistance. Newdale has improved peeling resistance, increased friability, acceptable enzyme and soluble protein levels, low wort beta-glucan, and fast modification. It also has fast conversion times and fast lautering in the brewhouse. Its very low wort beta-glucan content makes Newdale attractive to brewers who experience slow runoffs and poor beer filtration.

Legacy, a six-rowed cross of Excel/Bumper/Karl/Manker, was registered in 2002, and was developed by Dr. B. Cooper, Busch Agricultural Resources Inc., Ft. Collins, CO, USA. It has very good yield potential, maturing 2-3 days later than Robust, and 1 day later than Excel. Legacy has fair lodging resistance, low grain protein, and better disease resistance than most other six-rowed varieties. Malt characteristics include higher extract and enzyme levels, lower wort beta-glucan, and faster modification rates. Legacy has shown satisfactory brewhouse performance, with fast conversion times and satisfactory lautering times. Legacy's high enzyme package makes it ideal for high adjunct brewing.

Tradition, a six-rowed barley, a cross of 6B89-2126/ND10981, received full registration in Canada in 2004. It was developed by Dr. B. Cooper, Busch Agricultural Resources Inc., Ft. Collins, CO, USA. Tradition has good yield potential, kernel plumpness, and lodging resistance. Tradition has good extract, and high levels of DP with adequate alpha-amylase levels. Soluble protein levels are moderate. Tradition has satisfactory brewhouse performance, with fast conversion times and satisfactory lautering times. Its higher enzyme package makes it ideal for high adjunct brewing, similar to Legacy.

Growing and harvesting conditions

The 2010 planting season began well in southern and western growing areas, with favourable weather conditions allowing an early start to seeding. Dry soils in western Saskatchewan and central and northern Alberta due to drought conditions in 2009 were relieved by late season rain and snowstorms in May. Seeding progressed well in most areas with nearly two-thirds of the crop planted by the end of May. However, a series of storms during late May and early June resulted in heavy amounts of rainfall over most of Saskatchewan and Manitoba, delaying final planting and causing flooding in fields that had been previously planted. Overall planting progress was halted with approximatly 80 per cent of the Western Canadian crop sown.

Wet, cool conditions persisted through July and August, delaying crop development. Temperatures were the coolest in the western areas of the Prairies, while Manitoba and parts of eastern Saskatchewan were closer to normal. The only dry conditions could be found in the northern growing areas of Alberta during July, which caused stress to crops in the Peace River region. The Peace River region of Alberta and British Columbia experienced drought conditions for most of the growing season and was the only western region to report above normal temperatures.

The cool and wet conditions in eastern regions continued into September, delaying the onset of harvest. By the end of September only a quarter of the harvest was complete. A severe frost was reported in the middle of September in Alberta and western Saskatchewan which caused damage to many crops which were still inmature. Mostly dry conditions and above normal temperatures were reported across the entire Prairie region during October, which allowed for a rapid, although late, completion of the harvest.

Production, yields and quality

Barley production in Western Canada for 2010 was estimated at 6.9 million tonnes, representing a decrease of 22% compared to 2009 and 28% below the 10-year average. Seeded acres were down significantly in Manitoba and Saskatchewan compared to last year, and both well below the 10-year average (Table 3). Acres seeded to barley in Alberta remained consistant, returning production levels to normal after drought conditions 2009 reduced crop yield dramatically. Record high amounts of rainfall across the prairie provinces during this year's growing and harvest seasons resulted in a negative impact on crop production and quality.

Levels of thousand kernel weight and plumpness were lower than levels in 2009 due to cooler growing conditions which delayed seed maturity. Barley protein levels were moderate, increasing only slightly from 2009 and still below long term averages. Germination energy was aceptable, but significant water sensitivity was observed.

Rapid visco analysis (RVA) is becoming increasingly used by barley selectors to identify sound, moderately and strongly pre-germinated barley, and manage their supply accordingly. This year's RVA results revealed that a large proportion of malting barley selections exhibited definite signs of pre-germination (< 50 RVA units); a dramatic contrast to results from 2009. Barley in this condition has a high risk of loosing germination energy with prolonged storage. Sound barley (>120 RVA units) has a high probability of retaining germination energy for a long time; barley exhibiting only moderate pre-germination (50-110 RVA units) has good potential for storability provided proper cool and dry storage conditions. Among different barley varieties tested each year, the six-rowed variety Tradition consistently showed a higher percentage of sound samples. Tradition is known to exhibit dormancy which contributes to a greater resistance to pre-harvest sprouting.

Table 3 – Barley production in western Canada for 2010, 2009 and the 2001-2010 average[1]

	Seeded area			Production		
	2010	2009	2001-2010 average	2010	2009	2001-2010 average
	thousand hectares			thousand tonnes		
Manitoba	194	283	375	487	958	1 063
Saskatchewan	864	1 396	1 704	1 938	4 080	3 851
Alberta[2]	1 540	1 629	1 915	4 559	3 886	4 838
Total	**2 598**	**3 308**	**3 994**	**6 984**	**8 924**	**9 852**

[1] Statistics Canada, *Field Crop Reporting Series, No. 8*, December 2010
[2] Alberta figures include small amounts grown in British Columbia

Table 3 shows the following:

- Total seeded acreage was 35% lower than ten-year average levels.
- Total barley production in western Canada dropped by 22% from 2009.
- Total production of barley in 2010 was 28% lower than ten-year average levels.
- Barley production in Alberta returned to near average levels in 2010, increasing 17% from 2009

Sampling and survey methodology

The 2010 malting barley survey was based on 381,447 tonnes of malting barley selected for purchase by Cargill Grain Co. Ltd., Canada Malting Co.Ltd., Richardson Co. Ltd., Prairie Malt Co. Ltd, Parrish and Heimbecker Co. Ltd., Rahr Malting Co. Ltd., and Viterra Co. Ltd. The total tonnage included in this survey represented over one third of the total volume of malting barley selected in western Canada through mid-November.

Selections from these companies sent separate one-kilogram composites of barley to the Applied Barley Research Unit of the Grain Research Laboratory. Composites were based upon cultivar, province or region, tonnage, and selection period. Samples were received from the beginning of harvest until the 15th of November, at which time composite sample receival was terminated.

Samples received at the GRL were kept unique, and not further composited.

Malting quality

Germination characteristics of 2010 barley were the primary challenge to producing quality malt. While germination energy levels were within commercially acceptable limits, significant levels of water sensitivity were present. Initial malting runs indicated that higher than normal steep-out moisture levels and increased germination temperatures were necessary to achieve adequate levels of modification. A modified steeping schedule with shorter wet steeps and more frequent air rest periods was required to overcome water sensitivity tendencies (Table 4).

This year's study resulted in malts with average levels of extract, good levels of protein modification, slightly elevated beta-glucan levels, and more than adequate levels of enzyme activity. Good quality malt was possible from 2010 barley with the application of appropriate malting conditions.

Table 4 - Malting conditions used with Phoenix Micromalting System in 2010

Steeping	6 h wet steep, 16 h air rest, 8 h wet steep, 12 h air rest, 3 h wet steep, 3 h air rest @ 13°C
Germination	48 h @ 15°C, 48 h @ 16°C
Kilning	12h @ 60°C, 6h@ 65°C, 2h @ 75°C, 4h @ 85°C

AC Metcalfe

AC Metcalfe continues to be the dominant malting barley variety grown in Western Canada for the ninth year in a row. This year's barley had average quality characteristics despite challenging growing conditions across most of the Prairies. Thousand kernel weights and plumpness levels were lower than those of 2009 (Table 5). Protein levels were slightly higher than 2009, but still lower than average. Germination energy levels were adeqate, but significant water sensitivity was evident.

The quality of malt made from composites of selected AC Metcalfe barley was of average quality when appropriate adjustments were made to malting schedules to accommodate water sensitivity. Increasing steep out moistures permitted adequate endosperm modification resulting in only slightly higher wort beta-glucan levels than those of 2009, although malt yield was negatively impacted as a result. Malt extract levels in 2010 were lower than those of 2009 due to less plump kernels and higher protein. Overall protein modification was improved over last year, as indicated by higher levels of soluble protein and free amino nitrogen. Diastatic power and alpha-amylase levels were well above average.

Table 5. Quality data for 2010 harvest survey composite samples of AC Metcalfe malting barley

Origin of selected samples	Man/ Sask	Saskatchewan		Alberta/ Sask		Alberta		Prairie Provinces[1]	
Crop year	2010	2010	2009	2010	2009	2010	2009	2010	2009
Thousands of tonnes	4	78	119	90	215	58	61	230	395
Barley									
Physical characteristics									
Test Weight, Kg/hL	66.2	63.6	67.1	67.0	67.1	65.1	68.0	65.4	67.3
1000 kernel weight, g	43.4	39.7	45.3	41.2	43.8	43.4	44.9	41.3	44.4
Heavy grade, over 6/64" sieve, %	92.3	90.0	93.6	91.8	93.2	93.3	94.5	91.6	93.5
Intermed grade, over 5/64"sieve, %	5.7	7.5	4.7	6.6	5.2	4.9	4.2	6.5	4.9
Chemical analysis									
Moisture, %[2]	14.4	11.9	13.2	10.4	10.3	13.5	12.2	11.8	11.5
Protein, %	12.4	11.6	11.2	11.9	11.2	11.6	11.3	11.8	11.2
Germination, 4 ml (3 day), %	90	96	99	100	99	91	100	96	99
Germination, 8 ml (3 day), %	75	78	92	86	92	66	93	78	92
Malt									
Physical characteristics									
Yield, %	92.1	92.1	94.1	91.2	93.9	92.1	94.0	91.8	94.0
Steep-out moisture, %	49.4	49.8	46.0	49.2	45.6	49.5	45.3	49.5	45.7
Friability, %	62.6	66.1	75.0	66.7	72.8	61.4	74.6	65.1	73.7
Chemical analysis									
Moisture, %	5.3	5.5	5.1	5.6	5.3	5.6	4.9	5.5	5.2
Wort									
Fine grind extract, %	80.4	79.6	80.3	79.5	80.3	80.0	80.4	79.7	80.3
Coarse grind extract, %	79.8	78.8	79.8	79.5	79.8	79.2	79.7	79.2	79.8
F/C difference, %	0.6	0.8	0.5	0.0	0.5	0.8	0.7	0.5	0.5
ß-Glucan, ppm	89	158	85	50	71	158	88	115	78
Viscosity, cps	1.45	1.44	1.43	1.46	1.42	1.45	1.42	1.45	1.43
Soluble protein, %	5.32	4.79	4.43	4.92	4.47	4.77	4.41	4.84	4.45
Ratio S/T, %	43.2	40.8	39.6	40.6	39.4	41.1	38.7	40.8	39.4
FAN, mg/L	224	198	169	213	170	199	169	205	170
Colour, ASBC units	2.50	2.13	1.80	2.17	1.75	2.09	1.75	2.14	1.76
Diastatic power, °L	165	167	166	179	162	160	165	170	164
α-amylase, D.U.	64.6	64.8	69.3	74.6	71.3	60.6	67.1	67.6	70.1

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture- proof containers.

CDC Copeland

CDC Copeland is the second major two-rowed malting variety grown on the prairies. Its acreages and selection rates continue to increase. Levels of thousand kernel weight and plumpness were lower than levels in 2009 (Table 6). Protein levels were slightly higher than those in 2009, but still in an optimum range for good malting performance. Germination energy levels were below average in some regions, and water sensitivity was evident in most samples received; however, CDC Copeland barley was still within the range of commercially acceptable quality.

The malt made from composites of CDC Copeland in 2010 was of average quality. Lower than average barley protein helped to keep extract levels high, decreasing only slightly compared to 2009. Overall modification benefited from increased steep out moisture, resulting in acceptable levels of wort beta-glucan in malts from most regions, but was unable to compensate for poor germination energy in Alberta. Protein modification was good resulting in higher soluble protein and free amino nitrogen levels in the wort. Levels of diastatic power and alpha-amylase were much higher than average.

Table 6. Quality data for 2010 harvest survey composite samples of CDC Copeland malting barley

Origin of selected samples	Man/ Sask	Saskatchewan		Alberta/Sask		Alberta		Prairie Provinces[1]	
Crop year	2010	2010	2009	2010	2009	2010	2009	2010	2009
Thousands of tonnes	3	21	46	40	67	27	6	92	121
Barley									
Physical characteristics									
Test Weight, kg/hL	64.9	63.0	66.3	64.7	68.2	65.2	66.7	64.5	67.4
1000 kernel weight, g	45.4	42.6	47.0	41.1	47.2	45.7	47.6	43.0	47.1
Heavy grade, over 6/64" sieve, %	93.4	90.3	94.3	91.7	95.5	94.5	95.2	92.3	95.0
Intermed grade, over 5/64"sieve, %	4.4	7.1	4.3	6.9	3.5	4.0	3.7	6.0	3.8
Chemical analysis									
Moisture, %[2]	13.8	13.8	13.4	9.8	11.1	13.7	12.0	12.0	12.0
Protein, %	11.0	11.2	10.9	11.6	10.6	10.7	11.6	11.2	10.8
Germination, 4 ml (3 day), %	90	96	99	99	99	90	100	96	99
Germination, 8 ml (3 day), %	80	80	94	91	98	72	98	83	97
Malt									
Physical characteristics									
Yield, %	92.8	92.6	94.3	91.4	93.8	92.3	94.1	92.0	94.0
Steep-out moisture, %	49.1	49.2	45.8	48.9	45.5	49.3	45.8	49.1	45.6
Friability, %	81.3	77.3	82.0	76.4	81.6	73.7	75.8	76.0	81.5
Chemical analysis									
Moisture, %	5.0	5.3	4.8	5.4	5.1	5.6	4.9	5.4	5.0
Wort									
Fine grind extract, %	81.2	79.5	79.9	79.8	80.0	80.0	79.3	79.8	79.9
Coarse grind extract, %	80.4	78.8	79.6	79.1	79.4	79.1	79.1	79.1	79.5
F/C difference, %	0.8	0.7	0.3	0.7	0.6	0.9	0.2	0.7	0.4
ß-Glucan, ppm	74	113	80	44	66	165	76	97	72
Viscosity, cps	1.44	1.42	1.43	1.41	1.42	1.46	1.43	1.43	1.42
Soluble protein, %	5.04	4.86	4.35	5.10	4.45	4.36	4.51	4.82	4.41
Ratio S/T, %	45.6	43.4	39.3	44.9	39.7	39.8	38.1	43.1	39.4
FAN, mg/L	204	200	158	208	159	169	161	194	159
Colour, ASBC units	2.50	2.48	1.81	2.36	1.62	2.01	1.85	2.29	1.71
Diastatic power, °L	129	140	137	153	139	131	141	143	138
α-amylase, D.U.	45.6	52.7	52.1	57.3	56.0	42.7	51.5	51.5	54.3

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Newdale

Newdale is included in the survey for the forth year in 2010, although selected tonnages of this variety remain low. Newdale barley grown in 2010 had slightly lower thousand kernel weight and plumpness, compared to 2009 (Table 7). Protein levels were higher than average this year, increasing from 2009. Germination energy levels were good, with evidence of some water sensitivity, but not as severe as in other two-rowed varieties.

The malt made from Newdale barley in 2010 was of average quality. Extract levels were lower than in 2009 due to higher barley protein and lower kernel plumpness. Beta-glucan and viscosity levels were slightly elevated from last year. Protein modification was good, resulting in adequate levels of soluble protein and FAN. Enzyme levels were good, with an increase in diastatic power from 2009 attributable to higher protein levels.

Table 7. Quality data for 2010 harvest survey composite samples of Newdale malting barley

Origin of selected samples	Manitoba/ Saskatchewan	Alberta		Prairie Provinces[1]
Crop year	2010	2010	2009	2010
Thousands of tonnes	3	2	6	5
Barley				
Physical characteristics				
Test Weight, Kg/hL	61.5	62.8	66.8	62.1
1000 kernel weight, g	41.0	41.3	46.5	41.1
Heavy grade, over 6/64" sieve, %	86.3	88.8	94.8	87.3
Intermed grade, over 5/64"sieve, %	9.6	8.7	4.1	9.2
Chemical analysis				
Moisture, %[2]	14.8	13.8	12.1	14.4
Protein, %	12.4	12.1	11.1	12.3
Germination, 4 ml (3 day), %	95	99	100	97
Germination, 8 ml (3 day), %	83	90	91	86
Malt				
Physical characteristics				
Yield, %	92.3	89.6	94.7	91.2
Steep-out moisture, %	50.4	50.9	45.9	50.6
Friability, %	72.3	78.7	82.3	74.8
Chemical analysis				
Moisture, %	4.7	5.7	4.9	5.1
Wort				
Fine grind extract, %	78.9	78.2	79.4	78.6
Coarse grind extract, %	78.0	77.9	79.1	77.9
F/C difference, %	0.9	0.4	0.3	0.7
ß-Glucan, ppm	105	35	42	77
Viscosity, cps	1.41	1.39	1.40	1.40
Soluble protein, %	4.78	4.86	4.06	4.81
Ratio S/T, %	38.9	40.1	36.4	39.3
FAN, mg/L	174	193	128	181
Colour, ASBC units	1.88	2.32	1.79	2.05
Diastatic power, °L	131	166	127	145
α-amylase, D.U.	54.9	63.8	56.9	58.5

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Legacy

The acreage and production volume of Legacy barley continued to decline this year across the Prairies. Legacy barley composites received in 2010 had thousand kernel weights and plumpness levels that were on average slightly lower than those of 2009, although this was not general across the regions (Table 8). Protein levels were elevated, increasing 1% above levels of 2009. Germination energy levels were acceptable, but significant water sensitivity was present across all growing regions.

The malt made from Legacy barley in 2010 was of good quality. Extract levels were only slightly lower than those of 2009. Endosperm modification benefited greatly from elevated steeping moisture, reducing wort beta-glucan and viscosity levels significantly from 2009. Protein modification was also enhanced, with soluble protein and FAN levels much higher than those of 2009. Diastatic power and alpha-amylase levels were above average, increasing as a result of elevated barley protein.

Table 8. Quality data for 2009 harvest survey composite samples of Legacy malting barley.

Origin of selected samples	Manitoba/ Saskatchewan		Saskatchewan		Prairie Provinces[1]	
Crop year	2010	2009	2010	2009	2010	2009
Thousands of tonnes	2	40	5	28	7	70
Barley						
Physical characteristics						
Test Weight, Kg/hL	64.4	64.8	63.0	65.5	63.3	65.1
1000 kernel weight, g	40.7	38.8	36.7	40.4	37.5	39.4
Heavy grade, over 6/64" sieve, %	96.0	92.6	91.2	94.5	92.2	93.3
Intermed grade, over 5/64"sieve, %	2.5	5.8	7.1	4.3	6.1	5.3
Chemical analysis						
Moisture, %[2]	13.5	10.5	11.6	12.8	12.5	11.5
Protein, %	12.2	11.0	12.3	11.1	12.3	11.0
Germination, 4 ml (3 day), %	91	99	96	99	95	99
Germination, 8 ml (3 day), %	66	87	69	92	68	89
Malt						
Physical characteristics						
Yield, %	91.2	94.4	91.4	94.9	91.3	94.6
Steep-out moisture, %	49.1	45.1	49.3	45.3	49.3	45.1
Friability, %	74.9	76.7	68.6	72.4	70.0	75.0
Chemical analysis						
Moisture, %	6.0	5.3	5.6	4.8	5.7	5.1
Wort						
Fine grind extract, %	78.9	79.1	78.2	78.7	78.4	78.9
Coarse grind extract, %	78.4	78.4	77.7	77.9	77.8	78.2
F/C difference, %	0.5	0.7	0.6	0.8	0.6	0.8
ß-Glucan, ppm	144	276	214	417	199	333
Viscosity, cps	1.42	1.45	1.46	1.50	1.45	1.47
Soluble protein, %	5.63	4.72	5.42	4.54	5.47	4.63
Ratio S/T, %	44.6	43.5	44.4	42.1	44.4	42.9
FAN, mg/L	251	185	243	179	244	182
Colour, ASBC units	2.79	1.89	2.33	1.97	2.43	1.92
Diastatic power, °L	194	177	207	158	204	168
α-amylase, D.U.	59.9	67.3	63.9	62.3	63.0	65.2

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Tradition

Selected composites of Tradition barley had average quality, with lower levels of plumpness and kernel weights than in 2009. Protein levels were slightly elevated, averaging nearly 0.5% higher than those of 2009. Germinative energy levels were reasonably good, but water sensitivity was present in varying degrees resulting from Tradition's dormancy which served to protect against the pre-harvest sprouting widely observed across the 2010 barley crop.

Malt made from selected composites of Tradition barley in 2010 was of acceptable quality. Extract levels were only slightly lower than in 2009. Wort beta-glucan was much lower than last year as a result of the gentle steeping schedule which helped to reduce the effects of water sensitivity. However, protein modification was still limited and malt yields were down significantly from 2009. Higher barley protein did enhance enzyme levels which were at the higher levels expected for a six-rowed malt.

Table 9. Quality data for 2010 harvest survey composite samples of Tradition malting barley

Origin of selected samples	Manitoba/ Saskatchewan		Saskatchewan		Prairie Provinces[1]	
Crop year	2010	2009	2010	2009	2010	2009
Thousands of tonnes	4	8	1	9	5	17
Barley						
Physical characteristics						
Test Weight, Kg/hL	65.4	66.5	67.2	66.4	65.6	66.5
1000 kernel weight, g	39.1	39.7	41.1	41.4	39.3	40.6
Heavy grade, over 6/64" sieve, %	94.3	94.2	92.4	96.0	94.1	95.2
Intermed grade, over 5/64"sieve, %	4.4	4.4	5.6	3.1	4.6	3.7
Chemical analysis						
Moisture, %[2]	11.0	11.4	13.1	12.4	11.3	11.9
Protein, %	12.2	11.7	12.5	11.7	12.2	11.7
Germination, 4 ml (3 day), %	98	100	95	91	98	95
Germination, 8 ml (3 day), %	80	85	57	89	78	87
Malt						
Physical characteristics						
Yield, %	90.1	94.6	91.4	95.2	90.2	94.9
Steep-out moisture, %	49.3	45.9	48.1	45.3	49.2	45.6
Friability, %	73.1	63.9	67.6	63.8	72.4	63.9
Chemical analysis						
Moisture, %	5.7	5.2	5.3	4.9	5.7	5.0
Wort						
Fine grind extract, %	78.1	78.5	78.7	78.4	78.2	78.5
Coarse grind extract, %	77.5	77.6	78.0	77.3	77.5	77.5
F/C difference, %	0.6	0.9	0.7	1.1	0.6	1.0
ß-Glucan, ppm	81	213	180	352	93	287
Viscosity, cps	1.43	1.47	1.50	1.51	1.44	1.49
Soluble protein, %	4.78	4.32	4.77	4.24	4.78	4.28
Ratio S/T, %	39.2	36.9	38.6	36.1	39.2	36.5
FAN, mg/L	194	154	183	151	192	152
Colour, ASBC units	1.93	1.57	1.63	1.54	1.89	1.55
Diastatic power, °L	217	184	197	171	214	177
α-amylase, D.U.	62.3	54.3	59.1	47.9	61.9	50.9

[1] Weighted average values

[2] Moisture not representative of new crop moisture levels as samples were not collected or stored in moisture-proof containers.

Methods

This section describes methods used at the Grain Research Laboratory. Unless otherwise specified, analytical results for barley and malt are reported on a dry weight basis. The ASBC methods cited are those of the American Society of Brewing Chemists, Ninth Edition, (2009).

α-amylase activity

α-Amylase activity is determined using ASBC method MALT 7B automated to run on a Skalar segmented flow analyser, using ASBC dextrinized starch as the substrate, and calibrated with standards that have been determined by method ASBC Malt 7A.

Beta-Glucan content

Beta-Glucan content is determined in malt extract by Skalar segmented flow analysis using Calcofluor staining of soluble, high molecular weight ß-glucan (ASBC Wort-18).

Diastatic power

Diastatic power is determined on a Skalar segemented flow analyzer, using an automated neocuproin assay for reducing sugars, which is calibrated using malt standards analysed using the official ferricyanide reducing sugar method, (ASBC Malt 6A).

Dockage and assortment

Dockage - Dockage-free barley is obtained by passing an uncleaned sample through a Carter Dockage Tester arranged as described in the Canadian Grain Commission's Official Grain Grading Guide for dockage determination. This involves passing the barley over a #6 riddle, #6 and #5 Buckwheat sieves. Material retained above the #5 sieve is considered to be dockage-free.
Assortment - All samples are passed through a Carter Dockage Tester equipped with a No. 6 riddle to remove foreign material and two slotted sieves to sort the barley. Heavy Grade barley is the material retained on a 6/64" (2.38 mm) x 3/4" slotted sieve. Intermediate Grade is barley that passes through the 6/64" x 3/4" sieve but is retained on a 5/64" (1.98 mm) x 3/4" slotted sieve.

Fine-grind and coarse-grind extracts

Extracts are prepared using an Industrial Equipment Corporation (IEC) mash bath and the Congress mashing procedure from 45°C to 70°C. Specific gravities are determined at 20°C with an Anton Paar DMA 5000 digital density meter (ASBC Malt-4).

Free Amino Nitrogen (FAN)

Free amino nitrogen is determined on the fine extract according to the official ASBC method Wort-12, automated to run on a Skalar segmented flow analyzer.

Germination energy

Germination energy is determined by placing 100 kernels of barley on two layers of Whatman #1 filter paper, in a 9.0 cm diameter petri dish, and adding 4.0 ml of purified water. Samples are controlled at 20 degrees Celcius and 90% relative humidity in a germination chamber. Germinated kernels are removed after 24 and 48 hours and a final count is made at 72 hours (ASBC Barley 3C, IOB, and EBC procedure).

Kolbach index (ratio S/T)

Kolbach index is calculated from the formula, (% Soluble protein/% Malt protein) x 100.

Micromalting

Malts are prepared using an Automatic Phoenix Micromalting System designed to handle twenty-four 500 g samples of barley per batch.

Malt mills

Fine-grind malt is prepared with a Buhler-Miag disc mill set to fine-grind. Coarse-grind malt is prepared with the same mill set to coarse-grind. The settings for fine- and coarse-grinds are calibrated quarterly, based on the screening of a ground ASBC standard check malt (ASBC Malt-4).

Moisture content of barley

Moisture content of barley is predicted using NIR equipment that has been calibrated by the standard ASBC method (ASBC Barley 5C).

Moisture content of malt

Moisture content of malt is determined on a ground sample by oven drying at 104°C for 3 hours (ASBC Malt-3).

Protein content (N x 6.25)

Protein content is predicted on dockage-free barley using NIR equipment that has been calibrated by Combustion Nitrogen Analysis (CNA). CNA is determined on a LECO Model FP-428 CNA analyser calibrated by EDTA. Samples are ground on a UDY Cyclone Sample Mill fitted with a 1.0-mm screen. A 200-mg sample is analysed as received (it is not dried prior to analysis). A moisture analysis is also performed and results are reported on a dry matter basis (ASBC Barley 7C).

Rapid Viscometric Analysis

The degree of pre-germination in barley was determined as described by Izydorczyk (2005); see the CGC website at www.grainscanada.gc.ca. Click on Grain research tab on left side, scroll down to technologies . There find project report: Prediction of germination energy of malting barley during long term storage. Grain Research Lab, Canadian Grain Commission, Winnipeg, Canada. Samples were analyzed using the RVA-4 (Newport Scientific) and the Stirring Number Program. Final viscosity values were presented in Rapid Visco Units (RVA).

Viscosity

Viscosity is measured on fine grind Congress wort using an automated Schott AVS 500 Micro-Ubbelodhe glass capillary viscometer, which has been calibrated according to ASTM method D-445 (ASBC Wort-13).

Water sensitivity

Water sensitivity is determined exactly as described for germination energy, except that 8.0 ml of purified water is added to each petri dish (ASBC 3C, IOB and EBC procedure). The actual water sensitivity value is the numerical difference between the 4ml and 8ml tests. (Note: the water sensitivity value is not reported in the data tables but is inferred by inclusion of the result of the 8 ml test).

Weight per thousand kernels

A 500 gram sample of dockage-free barley is divided several times in a mechanical divider to obtain two equal portions of 40 grams. All foreign material and broken kernels are removed from one 40 gram portion and the net weight determined. The number of kernels is then counted with a mechanical counter and thousand kernel weight is calculated (as is basis) (Institute of Brewing's Recommended Methods of Analysis, Barley 1.3 (1997)).

Wort-soluble protein

Wort-soluble protein is determined spectrophotometrically using ASBC method Wort-17.

Acknowledgments

The Grain Research Laboratory is grateful for the contributions of:

- Domestic grain handling companies and malting companies for providing composite samples of varietal selections of malting barley, especially to Ms. Chantelle Donahue, Prairie Malt Ltd., (Biggar, Sk), Ms. Brenda Carter, Mr. Randy Pasternak, Mr. Dave Wolfe, Cargill Grain Ltd. (Winnipeg), Mr. Leigh Lamontagne, Viterra Ltd. (Regina), Mr. Jeff Goosen, Mr. Fern Jeanson, Richardson Ltd.(Winnipeg), Mr. Spish Wisniewski of Parrish and Heimbecker Ltd. (Winnipeg), Mr. Bruce French and Mr. Fang So of Canada Malting Ltd. (Calgary), and Mr. Kevin Sich of Rahr Malting Ltd, (Alix).
- Bruce Burnett, of the Weather and Crop Surveillance Section of the Canadian Wheat Board, for providing the synopsis of weather and growing conditions affecting the quality of malting barley.
- Statistics Canada, for their publication on seeding and production figures.
- The staff of the GRL-Applied Barley Research Section: Shawn Parsons for barley analysis and micromalting, Debby Shaluk for complete malt analysis and Samantha Simnon for technical assistance.
- Anna Chepurna and Len Dushnicky of GRL-Basic Barley Research Section for performing RVA analysis on all the barley composite samples.
- The staff of the Multimedia Section of the Corporate Services Division of the CGC for their expertise in assembling this publication.